distance of the nucleus from the small star so often mentioned was 125″·16, as a result of six settings; nor could a trace of anything, except the old nucleus, be seen near the centre of the nebulosity, with a power of 229 on the 15-inch. The nebula was also swept over with the 6-inch object-glass prism on October 22, when nothing was seen in the diffused image to indicate the presence of a star.

Dun Echt Observatory:
1886, *Dec.* 7.

Formulæ for Binary Stars. By J. E. Gore.

For the following binary stars, of which the observations are not yet sufficient for the calculation of a satisfactory orbit, I have computed, by the method of least squares, the following empirical formulæ for the calculation of an ephemeris. The positions of the stars are for 1880·0:—

Σ 3116.

R.A. $6^{h}\ 15^{m}{\cdot}9$, $-11^{\circ}\ 42'$.

Magnitudes 6·2 and 10.

$$\theta = 21^{\circ}{\cdot}89 + 0^{\circ}{\cdot}1425\ (t - 1850).$$

$$\rho = 4''{\cdot}14 - 0''{\cdot}018\ (t - 1850).$$

45 Geminorum = OΣ 165.

R.A. $7^{h}\ 1^{m}{\cdot}5$, $+16^{\circ}\ 8'$.

Magnitudes 5, 10·7.

$$\theta = 127^{\circ}{\cdot}72 - 1^{\circ}{\cdot}585\ (t - 1850) - 0^{\circ}{\cdot}00811\ (t - 1850)^2.$$

$$\rho = 3''{\cdot}697 - 0''{\cdot}0434\ (t - 1850).$$

9 Argûs = Burnham 101.

R.A. $7^{h}\ 46^{m}\ 13^{s}$, $-13^{\circ}\ 35'$.

Magnitudes 5, 7.

$$\theta = 291^{\circ}{\cdot}38 + 3^{\circ}{\cdot}044\ (t - 1875).$$

$$\rho = 0''{\cdot}517\ (1875).$$

Σ 1175.

R.A. $7^{h}\ 56^{m}{\cdot}1$, $+4^{\circ}\ 30'$.

Magnitudes 7·8, 9·7.

$$\theta = 211^{\circ}{\cdot}16 + 0^{\circ}{\cdot}369\ (t - 1850).$$

$$\rho = 1''{\cdot}949\ (1850).$$

Σ 1287.

R.A. $8^{h}\ 44^{m}{\cdot}9$, $+12^{\circ}\ 35'$.

Magnitudes 8, 10·3.

$$\theta = 100^{\circ}{\cdot}83 - 0^{\circ}{\cdot}442\ (t - 1850).$$

$$\rho = 1''{\cdot}675 + 0''{\cdot}013\ (t - 1850).$$

Σ 1389.

R.A. $9^h\ 45^m\cdot5$, $+27°\ 33'$.

Magnitudes 8, 9.

$\theta = 321°\cdot87 - 0°\cdot378\ (t-1850)$.

$\rho = 1''\cdot86 + 0''\cdot0097\ (t-1850)$.

OΣ 215.

R.A. $10^h\ 9^m\cdot7$, $+18°\ 20'$.

Magnitudes 7, 7·2.

$\theta = 255°\cdot60 - 1°\cdot103\ (t-1850)$.

$\rho = 0''\cdot445 + 0''\cdot0116\ (t-1850)$.

Σ 1879.

R.A. $14^h\ 40^m\cdot4$, $+10°\ 10'$.

Magnitudes 7·8, 8·8.

$\theta = 54°\cdot64 - 0°\cdot522\ (t-1850)$.

$\rho = 0''\cdot716$ (1850).

Anon. Herculis = Gledhill 528.

R.A. $16^h\ 40^m\cdot3$, $+43°\ 42'$.

Magnitudes 8, 8.

$\theta = 132°\cdot93 - 2°\cdot441\ (t-1870)$.

$\rho = 0''\cdot957$ (1870) (distance diminishing).

Σ 2536.

R.A. $19^h\ 26^m\ 16^s$, $+17°\ 32'$.

Magnitudes 8, 11.

$\theta = 45°\cdot29 + 0°\cdot761\ (t-1850)$.

$\rho = 1''\cdot852$.

OΣ 437.

R.A. $21^h\ 15^m\cdot9$, $+31°\ 56'$.

Magnitudes 7, 10·5 (6·5, 7·2 Perrotin, 1885·720).

$\theta = 62°\cdot53 - 0°\cdot434\ (t-1850)$.

$\rho = 1''\cdot34$ (1850) ($1''\cdot600$ Perrotin, 1885·720).

72 Pegasi = Burnham 720.

R.A. $23^h\ 28^m$, $+30°\ 40'$.

Magnitudes 6, 6·1.

$\theta = 310°\cdot98 + 2°\cdot229\ (t-1880)$.

$\rho = 0''\cdot404$ (1880).

Formulæ for most of the other binary stars, computed by Drs. Doberck and Dunér, will be found in Gledhill's *Handbook of Double Stars*, and the "Corrections, Notes, &c.," to this excellent work.

Mr. Sherman's Observations of Bright Lines in Stellar Spectra.
By E. W. Maunder.

I fear, from Mr. Sherman's reply to my former Paper, that I was not sufficiently explicit in my criticism of his observations, for he certainly seems to have missed the point of my remarks. Nor has he yet explained his method of procedure in such a way that I can understand it.

His object is "to render the image of the bright line light as broad and intense as may be, and the intensity of the background light a minimum." I see but one way of attaining this end: viz., by employing as high a dispersion as the star will bear, and by making the spectrum as pure as possible by the use of a long collimator and narrow slit. Mr. Sherman has indeed employed a fairly high dispersion, but so far as I can judge has made no effort to secure purity of spectrum.

We may take it that the image of a star in the primary focus of a telescope is practically a point. The spectrum of a star is therefore a straight line, and as the image of the star has no very appreciable breadth it is not necessary, in order to see the spectrum, to use a slit. The star will, as Mr. Sherman truly argues, act as a slit for itself. If, then, certain radiations be missing in the star's light we shall have the coloured line of the star spectrum broken by dark points, each dark point being a negative image of the star. If certain radiations in the star's light be exceedingly brilliant we shall have them appearing as bright points on the coloured line of the star spectrum, each bright point being an image of the star; and indeed the entire continuous spectrum is but a succession of an infinite number of various coloured images of the star. By what means then does Mr. Sherman secure that his bright lines are of a *greater* breadth than the star spectrum when he uses no cylindrical lens, and of a *less* breadth than the star spectrum when he broadens it out into a band by the use of a cylindrical lens?* How is it that they escape the broadening effect of the cylindrical lens whilst the spectrum on which they stand is widened out? It was this point in particular which made me say (*Monthly Notices*, vol. xlvi. p. 283): "It seems very difficult to believe that this can be a description of the behaviour of true stellar bright lines," and not the changeable flickering appearance which Mr. Sherman ascribes to them, though I confess that, in my view, added to the unlikelihood of their being true lines. My remarks as to the positions of the slit and cylindrical lens were also directed to this point, as I thought it possible that with a slit badly adjusted and the cylindrical lens close to the eye, false images, produced within the spectroscope, might present the very appearance Mr. Sherman has described of long lines in the red, and stellar points in the green. Per-

* "At the red end, under a sharp focus, they (the bright lines) stand out the full breadth of the spectrum, bearing somewhat the same relation to the background as the prominence to the solar spectrum. *In the brighter portion of the spectrum they are cut down to fine star-points.*"